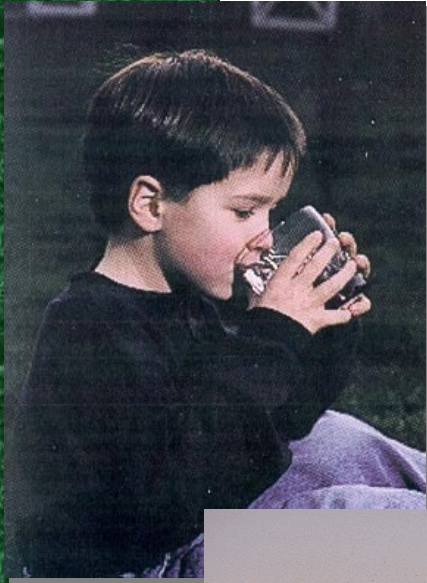
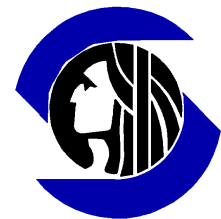


Seattle Public Utilities 2001 Water System Plan Update



April 2001

Seattle Public Utilities





**Seattle Public Utilities
Water System Plan
Update**

**City of Seattle
April 2001**

**Adopted by Ordinance No. 120633
(November 2001)**

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2001 Water System Plan Update April 2001

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Appendices

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- 1-A Water Facilities Inventory
- 1-B Seattle Zoning Map
- 1-C Wholesale Water Service Policy
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- 1-E Design Standards for Water Mains
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- 3-A Hydraulic Modeling Analysis Summaries
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- 4-C Firm Yield Report on Source Alternatives
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- 6-A Job Descriptions–Selected Positions Involving Water System Operations
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- 6-C List of Chemicals and Suppliers
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- 6-G Safety Principles
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- 6-I Cross-Connection Control Ordinance and Administration Rules
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- 7-A Design and Installation of Extensions or Replacements of Seattle’s Water Distribution System

- 8-A 2001-2006 Proposed Capital Improvement Program
- 8-B 2001-2025 Projected Capital Facilities Plan (April 15, 2000)

List of Abbreviations and Acronyms

ADD	Average Daily Demand
APWA	American Public Works Association
ASR	Aquifer Storage and Recovery
AWWA	American Water Works Association
BAT	Backflow Assembly Tester
CCCM	Cross Connection Control Manual
CCRR	Corrosion Control Recommendation Report
CCS	Cross Connection Specialist
ccf	Hundred cubic feet
CESSL	Cedar East Side Supply Line
CEU	Continuing Education Unit
CFP	Capital Facilities Plan
cfs	Cubic feet per second
CIP	Capital Improvement Program
CMMS	Computerized Maintenance Management System
COMPLAN	King County Comprehensive Plan
CPA	Water Conservation Potential Assessment
CRPL 1- 4	Cedar River Pipelines 1- 4
CRPL 2&4	Cedar River Pipelines 2&4
CSD	City of Seattle Datum
CT	Disinfectant (Concentration) x Contact (Time)
CWA	Cascade Water Alliance
CWD	Covington Water District
CWSP	Coordinated Water System Plan
D/DBPR	Disinfectant/Disinfection Byproducts Rule
DBO	Design Build Operate
DBPs	Disinfection Byproducts
DSC	Debt Service Coverage
DOH	Washington Department of Health
ECIP	Enhanced Capital Improvement Program
Ecology	Washington Department of Ecology
EIS	Environmental Impact Statement
EKC RWA	East King County Regional Water Association
EPA	United States Environmental Protection Agency
ERU	Equivalent Residential Unit
FCCCHR	Foundation for Cross Connection Control and Hydraulic Research
FERC	Federal Energy Regulatory Commission
Forum	Central Puget Sound Water Suppliers Forum
GIS	Geographic Information System
gpm	Gallons per minute
HAA	Haloacetic acid
HCP	Habitat Conservation Plan
HDPE	High-Density Polyethelene

ICR	Information Collection Rule
IFA	Instream Flow Agreement
IWRMS	Integrated Water Resource Management System
JISAO	Joint Institute for Study of the Atmosphere and Oceans
LCR	Lead and Copper Rule
LID	Local Improvement District
LIMS	Laboratory Information Management System
LYBP	Lake Youngs By-Pass Lines
LYSL 4 & 5	Lake Youngs Supply Lines 4 & 5
M	Million (\$)
M&I	Municipal and Industrial
MCL	Maximum Contaminant Level
MDD	Maximum Daily Demand
MG	Million gallons
mg/l	Milligrams per liter
MGD	Million gallons per day
N/A	Not Applicable
NAVD	North American Vertical Datum
NEPA	National Environmental Policy Act
NOM	Natural Organic Matter
NSF	National Sanitation Foundation
NTU	Nephelometric Turbidity Units
O&M	Operation and Maintenance
OCC	Operational Control Center
OSHA	Occupational Safety and Health Administration
Outlook	Central Puget Sound Water Supply Outlook
P5	Tacoma Pipeline Five
PE	Professional Engineer
PNWS	Pacific Northwest Section (of AWWA)
PRD	Peer Review Database
PRV	Pressure-reducing valve
PS	Pump Station
psi	Pounds per square inch
PSRC	Puget Sound Regional Council
RCW	Revised Code of Washington
RMPR	Risk Management Program Rule
rpm	Revolutions per minute
RWSP	Regional Wastewater Services Plan
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
SEPA	State Environmental Policy Act
SKC RWA	South King County Regional Water Association
SOCs	Synthetic Organic Chemicals
SPU	Seattle Public Utilities
SSP	Second Supply Project
SSRA	System Storage & Reliability Analysis

SWD	Seattle Water Department
SWTR	Surface Water Treatment Rule
SWUCC	Skyway Water Utility Coordinating Committee
TAZ	Transportation Analysis Zone
TCR	Total Coliform Rule
TESSL	Tolt East Side Supply Line
THMs	Trihalomethanes
TPL 1 & 2	Tolt River Pipelines 1 & 2
TPU	Tacoma Public Utilities
TSI	Tacoma-Seattle Intertie
TTHM	Total Trihalomethanes
ug/l	Micrograms per liter
UFC	Uniform Fire Code
UGA	Urban Growth Area
USC	University of Southern California
USFS	United States Forest Service
USGS	United States Geological Survey
VOCs	Volatile Organic Chemicals
WAC	Washington Administrative Code
WDM	Water Distribution Manager
WETRC	Washington Environmental Training Resource Center
WFI	Water Facility Inventory and Report Form
WISHA	Washington Industrial Safety and Health Act
WMD	Watershed Management Division
WHPA	Wellhead Protection Area
WHPP	Wellhead Protection Program
WRIA	Water Resource Inventory Area
WSCP	Water Shortage Contingency Plan
WSPL	West Seattle Pipeline
WTPO	Water Treatment Plant Operator

Seattle Public Utilities 2001 Water System Plan Update Executive Summary

An Era of Stewardship

For more than a century, water resources developed and managed by the City of Seattle have supported the growth and prosperity of the Central Puget Sound region. The stages of the region's development are mirrored by the growing, changing role of Seattle Public Utilities (SPU). Through the 20th Century, Seattle developed and expanded its water system to keep up with the rapid growth of the region. By mid-century, pipelines were being built to carry water to Seattle's neighbors, as development and population growth spread around Lake Washington and throughout King County.

The growth of the Seattle water system was first driven by the rapid population expansion of Seattle and the surrounding Central Puget Sound region. Other drivers of change became increasingly evident during the last two decades. Environmental awareness, pressures of growth on natural ecosystems, rapid expansion of the role of State and Federal governments in regulating water utilities, and an increasingly complex set of political relationships have all worked to increase the challenge of managing a major public utility.

The Washington State Department of Health (DOH) requires water utilities to prepare and submit a water system plan (WSP) every six years. In 1993, the Seattle Water Department submitted a water system plan that was approved by DOH in 1995. This 2001 WSP Update carries forward the policies of that 1993 plan and provides the documentation and direction for implementing the key functions of the utility. It is designed to fulfill the legal obligations required by DOH. As SPU is both a public utility service for the City of Seattle and a regional water supply provider, the plan is both local and regional in its vision.

SPU's vision provides a foundation for actions ranging from preserving the heritage of our natural environment, to ensuring that water of adequate quantity and quality reaches neighborhoods in Seattle, and the surrounding region. The 2001 WSP summarizes Seattle's efforts to balance and satisfy all of the often conflicting and competing needs of its many constituents.

In 1993, the then Seattle Water Department WSP focused on several pressing and emerging issues of key importance:

- Compliance with changing mandates of the Safe Drinking Water Act (SDWA) to protect of public health;

- Defining strategies to meet the demands of a growing regional population;
- Planning for increased competition for available water supplies, particularly in-stream water needs for fish;
- The need to work more closely than in the past with other governments and agencies in the region;
- Aging infrastructure in need of repair, replacement, and enhancement.

Since the 1993 WSP was submitted each of these issues has been more clearly defined. SPU has also set a course of action to work through these issues.

The primary focus of this 2001 WSP is on Seattle's retail distribution system.

The Introduction of this 2001 WSP outlines SPU's ongoing role in addressing broad regional issues. However, the primary focus of this WSP is on Seattle's retail distribution system. The WSP is arranged and compiled to comply with DOH water system plan requirements. It provides a summary of the manner in which SPU is fulfilling its current and near term mission and obligations as a public water utility.

The first century of the regional Seattle water system was devoted primarily to identifying and developing water supplies suitable in quantity and quality for a large metropolitan region. As the second century of SPU begins, a shift has taken place to emphasize stewardship of resources, careful maintenance of the system, and a continued focus on public health. In its first century, Seattle could focus on developing its own system. In the 21st Century, circumstances require that Seattle act as a partner, sharing decisions and resources with a wide variety of cooperating and competing users. In this 2001 plan, SPU embraces the transition from an era of development and construction to an era of stewardship. For SPU, stewardship includes protection of environmental resources and system infrastructure as well as cooperating to meet regional water supply needs.

This plan is divided by topic into an Introduction and nine technical sections. In this Executive Summary, the key points of each section are cited and discussed briefly to provide a balanced overview of the plan.

Introduction – The Regional Role

SPU has become fully engaged in regional activities for a variety of purposes.

The Introduction to this WSP describes how SPU has undertaken or been involved in activities, that define Seattle's role in the region. It addresses issues such as the Tacoma Second Supply Project and the Central Puget Sound Water Suppliers Forum and others.

Since the 1993 Water Supply Plan, SPU has moved from seeing the need for regional cooperation and making tentative movements in that direction, to becoming fully engaged in numerous regional activities for a variety of

interrelated purposes. This section of the WSP describes how the utility has exercised its leadership in seeking solutions to regional problems.

Section 1 – Description of the Water System

SPU provides water to approximately 1.3 million people in the City of Seattle, King County, and a small portion of southwest Snohomish County. Total water provided from SPU water supply sources for these people averages around 150 million gallons per day (MGD). The Cedar River provides about 70 percent of this supply, the Tolt River provides about 29 percent, and the remaining 1 percent comes from the Highline Wellfield. These three sources have a firm yield of 160 MGD without the Tolt Treatment Facility. Completion of the facility will increase firm yield to 171 MGD.

Existing water sources are being maximized. In addition, SPU is working to manage demand through conservation and public education.

SPU has worked to fulfill the needs of a growing Seattle area population through two basic approaches. First, existing sources are being optimized through management of supply and through infrastructure improvements. In addition, SPU has worked to manage demand for water with an aggressive program of water conservation and public education. A combination of conservation, higher water rates, and improved system operations have kept total water consumption at manageable levels. In order to continue and expand on the system's efficient use of water, SPU has introduced a conservation program called the "1% Conservation Program." This program is designed to reduce regional per capita water use by 1% each year for the first ten years of the 21st Century. This rate of reduced consumption would be sufficient to accommodate expected growth without bringing new water supplies into the system.

Seattle sells water to 27 wholesale customers.

As suburban areas have grown, the amount of Seattle's water that is sold through 27 wholesale customers, called "purveyors," increased from 40 MGD in 1975 to 66 MGD in 1999. The 27 purveyors include cities and water districts. SPU has continued to discuss potential service with additional purveyors not currently buying Seattle water. In 1999, agreements were signed to provide water to Issaquah (through Bellevue) and to Covington Water District. SPU is also actively discussing potential service with water utilities in Sallal, North Bend, Water District 111, and Ames Lake.

Seattle's purveyors have been served under contracts that expire in 2012. Discussions with regard to new contractual terms and arrangements are actively underway among SPU and its wholesale customers.

Section 2 – Water Demand Forecast

Population in SPU's service area has steadily risen since 1975. However, total water demand from Seattle's supply has not followed this trend. During the 1970s and 1980s, most increases in demand came from growth

Total water demand is actually projected to decline slightly in the next ten years.

in the suburban purveyor areas served by SPU on a wholesale basis. This growth rate began to level off in the late 1980s, as increased rates and conservation programs stimulated conservation by customers, and operation of the system began to focus more on conserving water. The drought of 1992 brought a major behavioral change to customers of the system, as they adjusted to mandatory cutbacks on water supply. After 1992 the multiple effects of conservation, change in system operations, and higher water rates combined to halt the growth in purveyor demand and actually reduced demand within Seattle.

Seattle's 1993 Water Supply Plan correctly predicted that water demand would decline during the 1990s. In fact, declines have exceeded the 1993 Plan's forecasts. SPU updated the water demand forecast for this WSP, which reflects the impact of the new 1% Conservation Program. In this new forecast, total water demand is projected to decline slightly in the next ten years, dropping from average daily demand of 149 MGD in 1999 to 144 MGD in 2010. With the completion of the 1% conservation program in 2010, demand is expected to begin increasing and is projected to reach 159 MGD by 2020.

The forecast and current yield estimates indicate that SPU's water supply is sufficient to meet system needs until at least 2020. Section 2 includes details with regard to the demand forecast methodology.

Section 3 – System Analysis

The regional Seattle water system is a complex network of facilities that must be designed, constructed, operated, and maintained within a consistent overall plan. These facilities include dams, intakes, transmission lines, treatment plants, pump stations, distribution reservoirs, water mains, fire hydrants, meters, and valves.

The greatest investment in the capital program is for maintenance and replacement of the water system assets.

The greatest investment in the capital program is for maintenance and replacement of the assets of the water system, which are needed to assure reliable delivery of water to SPU's customers. Projects are included to replace, protect or refurbish watermains, pipelines, pump stations, reservoirs, hydrants, valves, meters and other appurtenances.

SPU has nine open reservoirs in its distribution system with capacities ranging from 2.5 to 68 million gallons (MG). For many years, the issue of open reservoirs has generated controversy. In the early 1990s, recurrent coliform samples in the system were attributed, in part, to the condition and operation of these open reservoirs. In order to maintain the high quality of water required to meet contemporary regulatory standards, SPU has developed a plan approved by DOH in 1996 for covering these open reservoirs by 2020.

Section 3 outlines studies and analyses undertaken by SPU to identify necessary facility improvements. The Water Main and Pipeline Condition

Assessment, System Deficiency Analysis, and Asset Management Program will guide improvements to the water distribution system.

Designing an appropriate water main replacement program is a balancing act. On one hand, SPU's goal is to realize optimum value from system components by using them for the full extent of their design life. On the other hand, replacement of system components such as water mains is crucial to maintaining water quality, reducing water loss in the system, and assuring adequate pressures and fire flows. In 1999, SPU initiated its Asset Management Program to address this need.

When modeling efforts are completed, and the infrastructure assessment is finalized, SPU staff will be able to optimize rehabilitation and replacement to meet economic, financial, and performance criteria.

An operational tool to help manage the system effectively is being introduced to SPU through contemporary hydraulic analysis. Recently developed computer modeling tools make it possible for utility staff to assess the hydraulic performance of the system in order to manage it most effectively, identify and address problems, and forecast the effect of system changes. Because modeling the entire system is a significant effort, the system is being modeled and analyzed sequentially on the basis of ten individual pressure zones. Two zones have been modeled, and the project is proceeding with other zones. When these modeling efforts are completed, and the infrastructure assessment is finalized, SPU staff will be able to optimize rehabilitation and replacement to meet economic, financial, and performance criteria.

In another application of hydraulic modeling, the System Storage and Reliability Analysis assessed the performance of the storage and transmission facilities under a range of emergency and peak demand scenarios. This innovative approach was found to be particularly well suited to the complex architecture of the Seattle system. It was used in developing the reservoir covering plan that is discussed in Section 3.

SPU is well within the parameters of regulatory compliance for current and emerging regulations.

SPU has played an active, positive role in the regulatory process associated with the SDWA. As an individual utility and as an active member of key water industry associations, SPU has brought its issues and perspectives to decision makers at the federal and State levels as a new regulatory environment has been created. With very few exceptions, Seattle's water has met or been better than applicable standards. In the instances where regulatory compliance has been an issue (i.e., the source water fecal coliform level and exceedance source of the lead action level) SPU has moved decisively to develop and implement solutions. Section 3 reviews the key regulations that apply to SPU. This section outlines the steps taken to achieve and maintain compliance. SPU is well within regulatory compliance parameters for current and emerging regulations, as demonstrated by the dramatic commitments made by SPU in the past few years including filtration and ozonation of the Tolt source, improved disinfection of the Cedar source, and covering open distribution system reservoirs.

The Tolt Treatment Facility will provide significant enhancement to the reliability of the Seattle system.

Major system improvement projects are underway at each of SPU's major surface sources. To enhance source reliability and improve water quality, a filtration facility is under construction for that supply. The facility is being developed under a design/build/operate (DBO) contract.

The Cedar River supply is also receiving significant capital investment to comply with new water quality regulations, with an ozonation treatment facility currently being designed.

Section 4 – Conservation Program, Water Right Analysis, System Reliability, and Interties

SPU was one of the first major water utilities outside of the arid Southwest to design and implement an aggressive water conservation program. Seattle was also among the first major water utilities to treat conservation and demand management as a potential water resource, rather than simply as a management tool. This conservation program, calling upon the strong environmental ethic of the Pacific Northwest, helped the SPU system operate through the 1992 drought and to help reduce total water consumption levels despite population increases in the service area.

A new effort, known as the “1% Conservation Program” will stretch existing resources.

The 1993 Water Supply Plan and the 1996 Long Range Regional Water Conservation Plan presented a vision and plan for the 1990s and beyond. The conservation programs presented in those earlier plans are now approaching their peak levels. The ambitious goals set forth in those plans have generally been exceeded. SPU is now launching a new effort to achieve additional supply increments through conservation in the first decade of the 21st Century. This effort is known as the “1% Conservation Program.”

In 1998, SPU completed a Water Conservation Potential Assessment, which found that savings of more than 24 MGD could be achieved at a cost less than the cost of new water supply. SPU adopted the 1% Conservation Program to tap the first 18 MGD of this potential by 2010. The plan calls for reducing demand by an additional 1% each year from 1999 to 2010. Section 4 provides extensive detail on the 1% Conservation Program.

The Source of Supply Analysis describes opportunities for optimizing the use of sources already developed.

Section 4 also offers a Source of Supply Analysis. This analysis describes opportunities for optimizing the use of sources already developed, innovative methods for meeting water needs, and new sources particularly where they require new or additional water rights.

While Seattle's existing supplies are expected to meet forecasted demands beyond 2020, SPU continues to explore numerous alternatives for additional supply that are presented in Section 4. In addition to the 1% Conservation Program, the Second Supply Project is expected to provide an increment of supply in the future. SPU is also a partner with the East

King County Regional Water Association on the Snoqualmie Aquifer project. Other supply alternatives considered include: additional conservation, Cedar Permanent Dead Storage, Lake Youngs Drawdown, South Fork Tolt Additional Drawdown, and North Fork Tolt Diversion. SPU is also studying non-traditional alternatives for future supply, such as use of reclaimed water.

Section 4 also provides a water rights assessment, a description of supply reliability, and a summary of the revised Water Shortage Contingency Plan. These elements of the plan demonstrate a serious commitment to system reliability in every reasonably foreseen circumstance.

Section 5 – Source Water Protection

Seattle has taken dramatic steps over recent decades to assure the maintenance and control over watershed and wellhead areas.

SPU is fortunate in that its water supply sources are remote from most sources of contamination and are subject to extensive control and management in the interest of public health. SPU has taken extensive steps over recent decades to continue the maintenance of controlled, healthy watershed and wellhead areas.

In the Cedar River watershed, SPU has been aggressive in acquiring watershed lands, it now owns virtually the entire 90,000 acre Cedar River watershed. Ownership will allow SPU to maintain the closed and restricted environment that has preserved the Cedar's historic water quality. A substantial portion of land ownership in the watershed was achieved through innovative trading of lands between SPU and the Federal Government. In this effort, SPU staff has taken a leading role in negotiations with Federal agencies and with members of Congress. Without the strict watershed control program employed on the Cedar River, it is unlikely that this source could maintain its unfiltered status.

Seattle has significantly increased its land ownership in the South Fork Tolt watershed in recent years.

SPU has carried out an active land acquisition program in the South Fork Tolt watershed in recent years. Since 1994, Seattle's ownership in this watershed has increased from 29% to 69%. For the portion of land not owned by the City, SPU has operating agreements with the remaining landowner (the U.S. Forest Service) to minimize activities harmful to water quality. Efforts continue to enhance and strengthen the management of the Tolt watershed for water quality purposes, which will help assure continued high quality water is delivered from the Tolt source.

Protection of SPU's third source of supply, the Highline Wellfield, is very different from that of the Cedar and Tolt watersheds. In the case of the wellfield, a wellhead protection program is required. SPU's wellhead protection program for the Highline Wellfield is submitted to DOH as a part of this plan. The wellhead protection program consists of these key elements:

- Assessment of susceptibility
- Inventory of potential sources of groundwater contamination

- Contingency plan
- Spill/Incident response planning
- Wellhead protection area management plan

An active program of wellhead protection and monitoring is designed to assure that the wellfield can continue to play its small but important part in the SPU supply picture for the foreseeable future.

Section 6 – Operation and Maintenance Program

This section outlines a number of important programs for the management of the SPU water system, including:

- Water system management and personnel
- Certification requirements and training for key utility positions
- Operation and control of the water system
- Comprehensive water quality monitoring plan
- Emergency response
- Safety procedures
- Cross connection control
- Customer complaint response
- Record keeping and reporting
- Improvements in the system's operation and maintenance program
- Managing and evaluating ongoing maintenance of the system

These parts of Section 6 are in compliance with the guidelines in the DOH Planning Handbook. There are also numerous appendices associated with this chapter to provide the fully required documentation.

Section 7 – Distribution Facilities Design and Construction Standards

This section provides detailed information to demonstrate SPU's compliance with design and construction standards prescribed by law for Washington's public water utilities in WAC 246-290.

For many years, SPU's engineers and technical staff have taken an active role in the water industry's study of materials and construction methods. The American Water Works Association (AWWA), a non-profit industry organization of which Seattle is an active member, establishes most industry standards.

SPU's Water Engineering Section provides detailed engineering review to ensure that standards are met and project goals are achieved. The engineering review process is managed through a Plan Review Database that is explained in Section 7.

SPU provides detailed engineering reviews of design and construction procedures.

Section 8 – Improvement Program

Section 8 addresses the methods and processes SPU uses to identify, prioritize, and implement capital projects. SPU has a systematic approach and develops two plans to reflect future capital requirements. The Capital Improvement Program (CIP) is a relatively short-term, 6-year program. It is part of the long-term, 25-year Capital Facilities Plan (CFP).

The CIP is designed to describe all capital projects to be undertaken during the following six years, with emphasis on detailed budget analysis for the first two years. The CIP is updated every two years as part of the City's budget process. Minor adjustments are made in mid-biennium. The CIP is submitted to the Seattle City Council for approval as part of the budget process. SPU is currently preparing the 2001-2006 proposed CIP. The proposed CIP along with the April 15, 2000, 2001-2025 projected CFP were the basis for the information in Sections 8 and 9.

Major, capital projects undertaken beginning in 1998 concentrated a great portion of capital spending in just a few high priority projects, such as the Tolt Treatment Facility and development of the Tolt 2 pipeline.

In contrast to the relatively short-term CIP, the CFP takes a longer view of capital needs. The purposes of the CFP are: (1) to ensure that capital needs are considered well in advance in an orderly, consistent manner; and (2) to provide a basis for long-term financial and rate forecasting.

The CFP is updated on a less frequent basis than the CIP. The most recent CFP update was in 1995. The CFP has been updated and projected for the period 2001-2025.

Capital projects are identified by a department-wide staff effort. Facilitated work sessions help staff members articulate system needs for eventual analysis and prioritization. Table ES-1 summarizes project categories reflected in the projected CFP draft through 2020.

High priority capital projects beginning in 1998 concentrated capital spending in just a few projects.

Table ES-1 Capital Facilities Plan Summary (Millions of Y2000 Dollars)					
	2001-2005	2006-2010	2011-2015	2016-2020	Total
Water Infrastructure	176.5	169.9	154.5	143.1	644.0
Water Quality	133.8	13.3	11.1	12.4	170.6
Water Supply and Conservation	65.2	26.0	3.8	2.6	97.6
Other Agency Projects	9.7	4.9	3.3	3.3	21.2
Technology	28.9	22.5	12.4	12.9	76.7
Totals	414.1	236.6	185.1	174.3	1,010.1

Section 9 – Financial Program

During the next 20 years, operating costs will increase as new treatment facilities are added and as new programs are implemented.

Section 9 reviews the financial requirements associated with the program of capital improvements and projected operating and maintenance costs of the water system. The section includes a long-term forecast of rates and financial performance.

During the next 20 years, operating costs will increase as new treatment facilities are added and as new programs such as the Cedar River Habitat Conservation Plan are implemented. The capital program also entails high levels of expenditures during this period. SPU's actions to assure regulatory compliance, maintain the environmental integrity of its watersheds, replace aging infrastructure on a timely basis, and install new capital facilities to achieve these goals mean higher rates in years to come.

To make rate comparisons over time meaningful, SPU uses the system-wide average cost of supplying one hundred cubic feet (ccf) of water as a unit of measure. Under SPU's current plan, this average rate is expected to increase in real terms from \$1.54 per ccf in 2001 to a peak of \$2.10 per ccf in 2010. Rates are expected to increase 3.5% per year over inflation during this ten year period. A significant portion of this rate increase is due to major capital improvements mandated by state and federal regulations.

Financial management of the system is directed by formal financial policies adopted by the City Council. Over the years, SPU financial managers have developed operating guidelines to implement these policies. These policies and guidelines, outlined in Section 9, are important to maintaining the water system's access to financial capital on favorable terms.

SPU will continue to rely on debt financing during the forthcoming six year planning period.

During the 1990s, the water utility financed a significant amount of infrastructure through the use of debt. Continued reliance on debt is expected during the planning period. Debt financing has the advantage of keeping rates low in the near-term, but it requires a growing share of each revenue dollar to pay off the debt. In 1990, 20 cents of each revenue dollar was used to repay loans. By 2005, 40 cents of each revenue dollar will be used to pay off loans. Other financial performance measures, such as the debt service coverage ratio and the debt-to-assets ratio, are also presented in Section 9.